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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte
MAXIMILIAN ANGEL, MICHAEL GOTSCHE, and KARL KOLTER

Appeal 2008-1877
Application 09/767,821
Technology Center 1600

Decided: April 24, 2008

Before TONI R. SCHEINER, DEMETRA J. MILLS, and RICHARD M. LEBOVITZ, *Administrative Patent Judges*.

LEBOVITZ, *Administrative Patent Judge*.

DECISION ON APPEAL

This is a decision on appeal from the final rejection of claims 1-3, 10, and 18-21. We have jurisdiction under 35 U.S.C. § 6(b). We reverse.

STATEMENT OF THE CASE

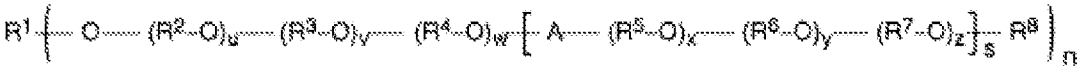
The claims are directed to a process of making a graft copolymer from vinyl esters and polyethylene glycols. The process comprises adding a free-

radical initiator system consisting of a free-radical initiator and polyethylene glycol which is liquid at room temperature. According to the Specification, dissolving the free-radical initiator in liquid polyethylene glycol "ensures safe management of the reaction" and "improved product properties" (Spec. 2: 45 to 3: 2) of the copolymer. No solvent is required (*id.* at 3: 3).

Claims 1-3, 10, and 18-21 stand rejected under 35 U.S.C. § 103(a) as obvious over GB '457 (Great Britain Patent Application No. 922,457, Apr. 3, 1963) and Wu (U.S. Pat. No. 5,338,814, Aug. 16, 1994) (Ans. 3).

Claim 1 is representative and reads as follows:

> 1. A process for preparing graft copolymers of polyvinyl esters which comprises polymerizing
>
> a) at least one vinyl ester of aliphatic C_1- C_{24}-carboxylic acids in the presence of
>
> b) polyethers which are solid at room temperature and have the general formula I



I

> in which the variables have the following meaning, independently of one another:

R^1	hydrogen, C_1- C_{24}-alkyl, R^9-C(=O)-, R^9-NH-(=O)-, polyalcohol residue;
R^8	hydrogen, C_1- C_{24}-alkyl, R^9-C(=O)-, R^9-NH-C(=O)-;
R^2 to R^7	$-(CH_2)_2-$, $-(CH_2)_3-$, $-(CH_2)_4-$, $-CH_2-CH(CH_3)-$, $-CH_2-CH(CH_2-CH_3)-$, $-CH_2-CHOR^{10}-CH_2-$;
R^9	C_1- C_{24}-alkyl;
R^{10}	hydrogen, C_1- C_{24}-alkyl, R^9-C(=O)-;
A	-C(=O)-O-, -C(=O)-B-C(=O)-O-, -C(=O)-NH-B-NH-C(=O)-O-;
B	$-(CH_2)_t-$, optionally substituted arylene;
n	1 to 8;

s	0 to 500;
t	1 to 12;
u	1 to 5000;
v	0 to 5000;
w	0 to 5000;
x	1 to 5000;
y	0 to 5000;
z	0 to 5000

c) and optionally at least one other monomer

by adding a free-radical initiator system, wherein the free-radical initiator system is a solution consisting of a free-radical initiator and a liquid polyethylene glycol having a molecular weight between 88 and 1000 which polyethylene glycol is liquid at room temperature.

ISSUE ON APPEAL

The issue in this appeal is whether the Examiner erred in finding that persons of ordinary skill in the art would have been motivated to have made the claimed invention by modifying the polymerization process of GB '457 by the addition of Wu's free-radical initiator solution consisting of PEG-300 and a free-radical initiator.

FINDINGS OF FACT

Scope and content of the prior art

In making an obvious determination, the Examiner must first identity the scope and content of the prior art. *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966). Thus, we first turn to the prior art. The following numbered findings of fact ("FF") summarize the prior art relied upon by the Examiner in setting forth the basis of the rejection.

GB '457

1. GB '457 describes a process for preparing graft copolymers of polyvinyl esters . . . [and] polyethylene glycols (PEG) having a molecular weight between 106 to several millions, preferably between 1000 to 30,000" (Ans. 3; GB '457, at 1, ll. 55-90 and 2, ll. 70-74).

2. Polymerization can be achieved with a free-radical catalyst such as diacetyl peroxide or dibenzyl peroxide (Ans. 3-4; GB '457, at 1, ll. 67-69 and 2, ll. 49-54).

3. "According to the nature of the polymer used[,] the grafting can take place at the ends of the polymer chains or along said chains by means of known chain transfer mechanisms" (GB '457, 1 at ll. 19-23).

4. Chemical analysis of the copolymer indicates that grafting of the monomers along the polyalkylene chains is induced by a radical-forming chain transfer mechanism (GB '457, 2 at ll. 17-21).

5. "To improve the probability of transfer, it is preferred to polymerize in homogenous phase in the absence of additional solvents" (GB '457, 2 at ll. 22-24).

6. Example 2 of GB '457 describes a process for preparing a graft polymer comprising heating a solution of vinyl benzoate, polyethylene glycol of a molecular weight of about 2,500, and the free radical catalyst dibenzoyl peroxide (Ans. 4; GB '457, at 4, ll. 85-100). Examples 3 and 4 are similar, but use vinyl acetate as the monomer (GB '457, at 5).

Wu patent

7. Wu describes polymerization of a vinylpyrrolidone (PVP) monomer in the presence of a polyethylene glycol having a molecular weight of 300 (PEG-300) and free-radical initiator (Ans. 4-5; Wu, at col. 2, ll. 40-52). An

example of a free-radical initiator, Lupersol 11 (t-butyl peroxy pivalate). (Wu, col. 3, l. 12-13.)

8. The PEG acts as a chain transfer agent to terminate the growing monomer chains and control the molecular weight and molecular distribution (polydispersity) of the polymer (Ans. 4-6; Wu, at col. 1, ll. 44-60; at col. 2, ll. 2 and 13-25).

9. Wu describes a process for preparing a narrow molecular weight distribution of a PVP polymer in which a free radical initiator (Vazo-67) in liquid PEG is added to a mixture comprising PVP and PEG-300 (Ans. 6; Wu, at col. 3, ll. 30-35).

Differences between the claimed invention and the prior art

Once the scope and content of the prior art has been determined, the next step is to identify the differences between the prior art and the claimed invention. *Graham*, 383 U.S. at 17. The following numbered findings of fact are pertinent to this issue:

10. Claim 1 is directed to a process for preparing graft polymers of polyvinyl esters comprising copolymerizing at least one vinyl ester of an aliphatic C_1-C_{24} carboxylic acid with polyethers of general formula I that are solid at room temperature.

11. The polymerization of claim 1 occurs "by adding a free-radical initiator system . . . consisting of a free-radical initiator and a liquid polyethylene glycol having a molecular weight between 88 and 1000 which . . . is liquid at room temperature."

12. GB '457 describes the same process recited in claim 1 (FF 1, 2, 6), but "does not specifically teach the addition of a free-radical initiator system in solution consisting of a free radical initiator and a liquid polyethylene glycol having a molecular weight between 88 and 1000" as in claim 1 (Ans. 4; FF 11).

13. However, this process limitation is taught by Wu who describes adding a solution consisting of liquid PEG-300 and a free radical initiator to a polymerization mixture (FF 6, 9).

Reason to combine the prior art

After ascertaining the differences between the prior art and the claimed invention, the next step is to identify motivation or a reason why persons of ordinary skill in the art would have been prompted to combine the prior art to have made the claimed invention. *KSR Int'l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1741 (2007). The following findings are relevant to this determination.

14. Persons of ordinary skill in the art at the time of invention would have been motivated to employ a free radical initiator as a solution in liquid polyethylene glycol as required by claim 1 (FF 11, 12) because

15. "1) Wu et al. teaches the advantage of using liquid . . . PEG-300 . . . [for] better control of the molecular weight distribution, [and] polydispersity, [during polymerization]" (Ans. 5; *see* FF 9).

16. "2) Wu et al. and GB '457 are both directed to a method of making polymers from monomeric units by free radical polymerization. Thus, [providing the reason] . . . to add free radical initiator as a solution in liquid

polyethylene glycol with the expectation of controlling the properties such as polydispersity of the graft polymers" (Ans. 5).

ANALYSIS

The "Examiner bears the initial burden, on review of the prior art . . , of presenting a prima facie case of unpatentability." *In re Oetiker*, 977 F.2d 1443, 1445 (Fed. Cir. 1992). Once prima facie obviousness has been established by the Examiner, Appellants have the burden of providing rebuttal arguments or evidence. *Hyatt v. Dudas*, 492 F.3d 1365, 1369-70 (Fed. Cir. 2007).

In this case, the Examiner has provided adequate evidence, unchallenged by Appellants, that GB '457 describes all the limitations of the claimed process, but not the step of "adding a free-radical initiator system . . . consisting of a free-radical initiator and a liquid polyethylene glycol having a molecular weight between 88 and 1000 which . . . is liquid at room temperature" (FF 1, 2, 11, 12). The Examiner finds that this step is described in Wu (FF 7, 9, 13) and that persons of skill in the art would have had reason to modify GB's process for the advantages described by Wu (FF 8, 9, and 14-16).

Appellants contend that the Examiner erred. They argue that there would not have been motivation to have utilized PEG-300, as in Wu, to control the molecular weight and polydispersity of the polymerization process described in GB '457 because the processes are different (App. Br.

7). Appellants state that the conditions in GB '457 are such that the monomers are grafted along the polyalkylene glycol chain (FF 4) to form a graft copolymer comprised of the monomers and polyalkylene glycol (App. Br. 7). However, in Wu, Appellants argue, a homopolymer of PVP is produced (*id.* at 6). Thus, Appellants assert that GB '457 teaches graft copolymerization, while Wu teaches homopolymerization of a single monomer (*id.* at 7). Because of these differences, Appellants conclude that the persons of skill in the art would not have reasonably expected "that the addition of a further chain transfer agent [i.e., PEG-300] to the reaction mixture of . . . [GB '457] would have any notable effect on polydispersity, or would allow a control of the molecular weight, of the graft copolymer of" GB '457 (Reply Br. 2).

Appellants also argue that GB '457 teaches that the probability of the graft transfer is improved by polymerization in the absence of solvents (Reply Br. 3; FF 5). However, Appellants assert that Wu describes the presence of water in its reaction (Reply Br. 4; FF 5). Thus, Appellants argue that under the conditions described in GB '457, PEG-300 would be converted into copolymer and would not serve to control the viscosity as the Examiner contends (Reply Br. 3).

Appellants have the better argument. While we agree that the Examiner has set forth sufficient evidence to establish prima facie obviousness of the claimed invention, we conclude that Appellants have provided sufficient evidence to rebut it.

We are convinced by Appellants' arguments that the processes described in GB '457 and Wu are different. In GB '457, the graft copolymer

is explicitly described as being formed from "the grafting of monomers along the polyalkylene glycol [PEG] chains" (GB '457, at 2, ll. 18-20; *see* FF 4). On the other hand, Wu states that the PEG is used to control molecular weight and polydispersity by terminating the growing monomer chain (FF 8). Thus, while it is true that Wu's PVP polymer appears to comprise some PEG, the PEG would be grafted to the ends of the growing PVP chain and would not have the copolymer structure described in GB '457 of monomers grafted along PEG chains (FF 4). As suggested by Appellants (Reply Br. 3), this difference could be a consequence of the preference for water solvent in Wu, but for its absence in GB '457 (FF 5).

Furthermore, GB '457 expressly states that "[a]ccording to the nature of the polymer used[,] the grafting can take place at the ends of the polymer chains or along said chains by means of known chain transfer mechanisms" (FF 3; GB '457, 1 at ll. 19-23). Thus, persons of skill in the art would have recognized that the difference in polymers and conditions described in GB '457 would result in grafting along the PEG chains, rather than at the terminus of the growing PVP chains as in the Wu patent. Accordingly, following the polymerization process in GB '457, such as Examples 2-4 (FF 6), it would not have been reasonably expected that the addition of PEG-300 would terminate the polymerization process and control polydispersity as it did in Wu's process. In sum, persons of skill in the art would not have been motivated to have added a solution consisting of a free-radical initiator and liquid PEG-300, as required by claim 1, to the polymerization mixture of GB '457 because it could not be predicted that the PEG would control polymer molecular weight and polydispersity as taught by Wu.

The Examiner asserts that Wu's process as described in Example 2 would result in a mixture of homopolymers and graft copolymers "because vinyl pyrrolidone monomer would also graft onto the PEO [sic, PEG] chain, since the radical formed on [the] PEO [sic, PEG] chain will also initiate polymerization of vinylpyrrolidone" (Ans. 7).

This argument is not persuasive. Wu does not describe the existence of graft copolymers in its product and the Examiner does not provide a reasonable basis for inferring that one is present. Thus, the burden did not shift to Appellants to provide evidence that graft copolymers are absent. *See re Spada*, 911 F.2d 705, 709 (Fed. Cir. 1990).

Because we find that the Examiner erred in concluding that it was obvious to have combined the disclosures of GB '457 and Wu, the obviousness rejection of claims 1-3, 10, and 18-21 is

REVERSED.

Ssc:

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